180225

FLOOD INSURANCE STUDY

TOWN OF INDIAN VILLAGE, INDIANA
ST. JOSEPH COUNTY

OCTOBER 15, 1980

federal emergency management agency
federal insurance administration

COMMUNITY NUMBER - 180225

FEMA-289

TABLE OF CONTENTS

		Page
1.0	INTRODUCTION	1
	1.1 Purpose of Study	1
	1.2 Coordination	1
	1.3 Authority and Acknowledgments	1
2.0	AREA STUDIED	1
	2.1 Scope of Study	1
	2.2 Community Description	3
	2.3 Principal Flood Problems	3
	2.4 Flood Protection Measures	3
3.0	ENGINEERING METHODS	4
	3.1 Hydrologic Analyses	4
	3.2 Hydraulic Analyses	6
4.0	FLOOD PLAIN MANAGEMENT APPLICATIONS	6
	4.1 Flood Boundaries	7
	4.2 Floodways	7
5.0	INSURANCE APPLICATION	10
	5.1 Reach Determinations	10
	5.2 Flood Hazard Factors	10
	5.3 Flood Insurance Zones	12
	5.4 Flood Insurance Rate Map Description	12
6.0	OTHER STUDIES	13
7.0	LOCATION OF DATA	13
8.0	BIBLIOGRAPHY AND REFERENCES	13

best copy available

TABLE OF CONTENTS (Cont'd)

Page

FIGURES

Figure 1 - Vicinity Map..... 2
Figure 2 - Floodway Schematic..... 8

TABLES

Table 1 - Summary of Discharges..... 5
Table 2 - Floodway Data..... 9
Table 3 - Flood Insurance Zone Data..... 11

EXHIBITS

Exhibit 1 - Flood Profiles
Judy Creek Panel 01P

Exhibit 2 - Flood Boundary and Floodway Map

PUBLISHED SEPARATELY:

Flood Insurance Rate Map

FLOOD INSURANCE STUDY

1.0 INTRODUCTION

1.1 Purpose of Study

The purpose of this Flood Insurance Study is to investigate the existence and severity of flood hazards in the Town of Indian Village, St. Joseph County, Indiana, and to aid in the administration of the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973. Initial use of this information will be to convert Indian Village to the regular program of flood insurance by the Federal Insurance Administration. Further use of the information will be made by local and regional planners in their efforts to promote sound land use and flood plain development.

1.2 Coordination

Community base map selection and corporate limits identification were coordinated during a meeting held on May 11, 1978, and attended by representatives of the Federal Insurance Administration, the Indiana Department of Natural Resources, the town, and the study contractor. The limits of detailed study for Judy Creek were also delineated during this meeting. Johnson & Anderson, Inc., and the Indiana Department of Natural Resources provided information used in this study.

The results of this study were reviewed at a final community coordination meeting held on May 22, 1980. Attending the meeting were representatives of the Federal Insurance Administration, the study contractor, the Indiana Department of Natural Resources, and the town. No problems were raised at the meeting.

1.3 Authority and Acknowledgments

The source of authority for this Flood Insurance Study is the National Flood Insurance Act of 1968, as amended.

The hydrologic and hydraulic analyses for this study were performed by Clyde E. Williams & Associates, Inc., for the Federal Insurance Administration, under Contract No. H-3596. This work, which was completed in June 1979, covered all significant flooding sources affecting the Town of Indian Village.

2.0 AREA STUDIED

2.1 Scope of Study

This Flood Insurance Study covers the incorporated areas of the Town of Indian Village, St. Joseph County, Indiana. The area of study is shown on the Vicinity Map (Figure 1).

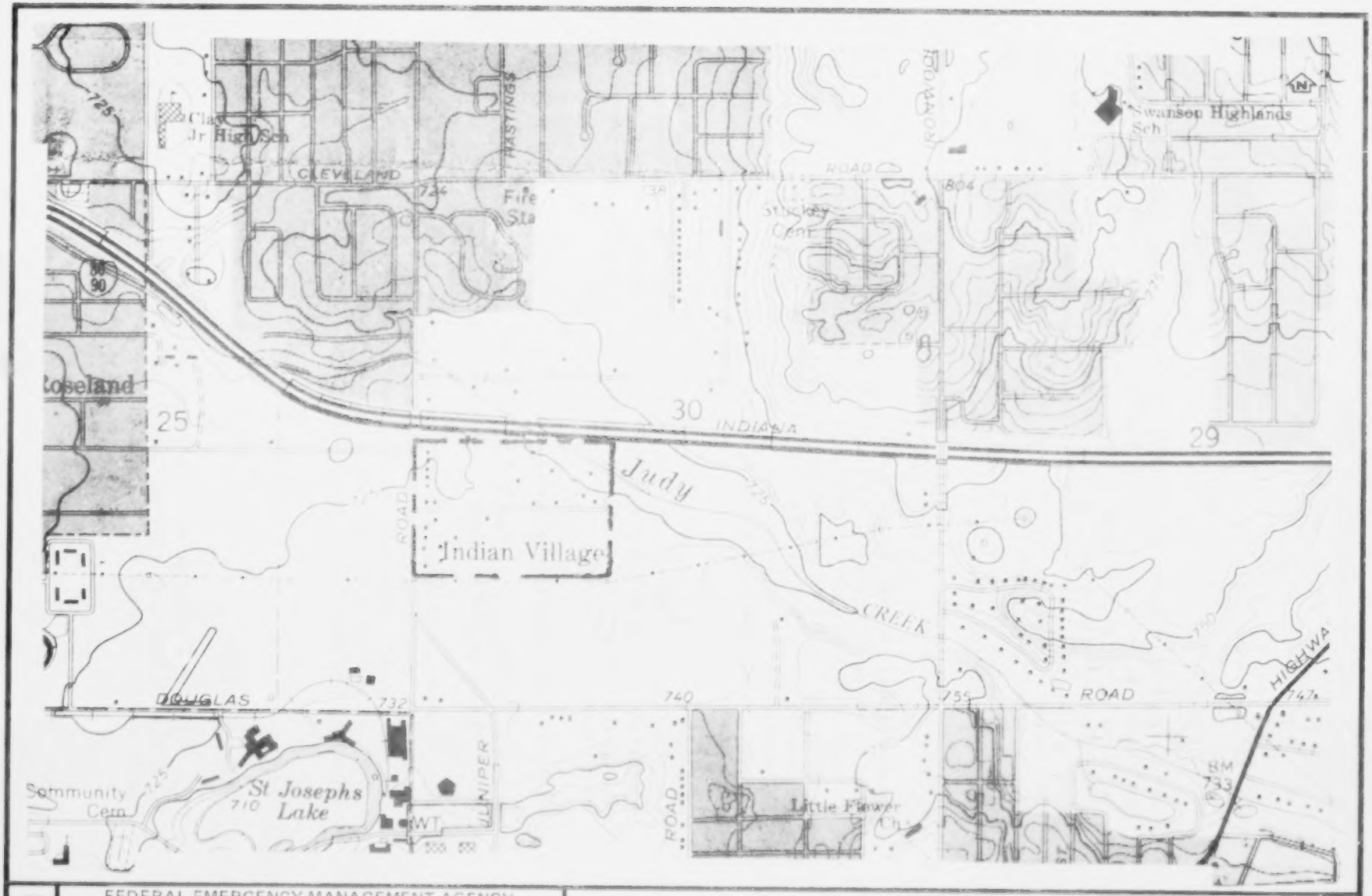


FIGURE 1

FEDERAL EMERGENCY MANAGEMENT AGENCY
Federal Insurance Administration

TOWN OF INDIAN VILLAGE, IN
(ST. JOSEPH CO.)

APPROXIMATE SCALE

16 0 16 32 48 MILES

VICINITY MAP

The portion of Judy Creek that lies within the corporate limits of Indian Village was studied by detailed methods, and it is the only source of flooding within the community.

Those areas studied by detailed methods were chosen with consideration given to all proposed construction and forecasted development through 1984.

2.2 Community Description

Indian Village is in north-central St. Joseph County, in north-central Indiana. Indian Village is surrounded by unincorporated county land. It is approximately 300 feet south of the Indiana Toll Road (Interstate Highways 80 and 90) and 1 mile east of U.S. Highway 31. It is 1 mile east of Roseland and 1.75 miles north of South Bend. The population, as listed in the 1970 census, was 86, which represented a 4.9 percent growth rate since the previous census (Reference 1).

All development is strictly residential within the study area. Indian Village has no plans for expansion as the University of Notre Dame owns land on three sides of the town.

The flood plain along Judy Creek in Indian Village is undeveloped; however, the fill for the Indiana Toll Road extends into the flood plain. Judy Creek flows through the northeastern corner of Indian Village from the southeast to the northwest and continues northwesterly until it joins St. Joseph River.

The predominant soils for the Judy Creek basin are of the Plainfield-Tyner-Oshtemo series. This series is characterized by sloping, excessively drained, sandy Plainfield on windblown sands; sloping and nearly level, excessively drained, sandy Tyner; and well-drained, loamy Oshtemo on outwash sand and gravel (Reference 2).

The terrain in Indian Village is level. The yearly average temperature is 50°F, and the average annual rainfall is 35.4 inches.

2.3 Principal Flood Problems

During periods of heavy rain, frequent flooding occurs along low-lying areas of Judy Creek. Since the incorporation of Indian Village in 1940, no serious flooding problems have been recorded.

2.4 Flood Protection Measures

Within the corporate limits of Indian Village, no flooding has been reported. Thus, no substantial flood protection works have been built, nor are any planned. No flood plain management ordinances are in effect in Indian Village.

3.0 ENGINEERING METHODS

For the flooding sources studied in detail in the community, standard hydrologic and hydraulic study methods were used to determine the flood hazard data required for this study. Flood events of a magnitude which are expected to be equalled or exceeded once on the average during any 10-, 50-, 100-, or 500-year period (recurrence interval) have been selected as having special significance for flood plain management and for flood insurance premium rates. These events, commonly termed the 10-, 50-, 100-, and 500-year floods, have a 10, 2, 1, and 0.2 percent chance, respectively, of being equalled or exceeded during any year. Although the recurrence interval represents the long term average period between floods of a specific magnitude, rare floods could occur at short intervals or even within the same year. The risk of experiencing a rare flood increases when periods greater than 1 year are considered. For example, the risk of having a flood which equals or exceeds the 100-year flood (1 percent chance of annual occurrence) in any 50-year period is approximately 40 percent (4 in 10), and, for any 90-year period, the risk increases to approximately 60 percent (6 in 10). The analyses reported here reflect flooding potentials based on conditions existing in the community at the time of completion of this study. Maps and flood elevations will be amended periodically to reflect future changes.

3.1 Hydrologic analyses

Hydrologic analyses were carried out to establish the peak discharge-frequency relationships for floods of the selected recurrence intervals for the stream studied in detail in the community.

Values of the 10-, 50-, 100-, and 500-year peak discharges were obtained directly from the Flood Insurance Study for St. Joseph County, Indiana (Reference 3).

Peak discharge-drainage area relationships for Judy Creek are shown in Table 1.

Table 1: Summary of Discharges

Flooding Source and Location	Drainage Area (Square Miles)	Peak Discharges (Cubic Feet per Second) 10-Year	50-Year	100-Year	500-Year
Judy Creek At Mouth	38	592	760	831	984

3.2 Hydraulic Analyses

Analyses of the hydraulic characteristics of the stream in the community were carried out to provide estimates of the elevations of floods of the selected recurrence intervals along the stream studied in the community.

Water-surface elevations of floods of the selected recurrence intervals were computed through use of the U.S. Army Corps of Engineers HEC-2 step-backwater computer program (Reference 4). Cross section data for Judy Creek were obtained from U.S. Geological Survey topographic maps (Reference 5). Below-water elevations were field surveyed. The culvert at the Indiana Toll Road was surveyed in order to obtain elevation data and structural geometry to use in computing the significant backwater effect of this structure.

Locations of selected cross sections used in the hydraulic analyses are shown on the Flood Profile (Exhibit 1).

Roughness coefficients (Mannings "n" values) were based on conditions at the time of the field survey. These values ranged from 0.020 to 0.060 in the natural channel and from 0.035 to 0.140 in the overbank areas of Judy Creek.

For Judy Creek above Roseland, the starting water-surface elevations were based on the Roseland Flood Insurance Study (Reference 6).

Flood profiles were drawn showing computed water-surface elevations to an accuracy of 0.5 foot for floods of the selected recurrence intervals (Exhibit 1).

The hydraulic analyses for this study are based only on the effects of unobstructed flow. The flood elevations, as shown on the profiles, are thus considered valid only if hydraulic structures, such as bridges and culverts, remain unobstructed.

All elevations are referenced to the National Geodetic Vertical Datum of 1929 (NGVD). Elevation reference marks used in the study are shown on the maps.

4.0 FLOOD PLAIN MANAGEMENT APPLICATIONS

A prime purpose of the National Flood Insurance Program is to encourage State and local governments to adopt sound flood plain management programs. Each Flood Insurance Study, therefore, includes a flood boundary map designed to assist communities in developing sound flood plain management measures.

4.1 Flood Boundaries

In order to provide a national standard without regional discrimination, the 100-year flood has been adopted by the Federal Insurance Administration as the base flood for purposes of flood plain management measures. The 500-year flood is employed to indicate additional areas of flood risk in the community. For the stream studied in detail, the boundaries of the 100- and 500-year floods have been delineated using the flood elevations determined at each cross section. Because the two cross sections used for determining flood elevations were not within the study limits, the road profiles were surveyed at Sweeney, Lamar, Elmhurst, and Palmer Streets. Between the roads, the boundaries were interpolated using topographic maps at a scale of 1:24,000, with a contour interval of 5 feet (Reference 5).

In cases where the 100- and 500-year flood boundaries are close together, only the 100-year flood boundary has been shown.

Flood boundaries for the 100- and 500-year floods are shown on the Flood Boundary and Floodway Map (Exhibit 2).

Small areas within the flood boundaries may lie above the flood elevations and, therefore, not be subject to flooding; owing to limitations of the map scale, such areas are not shown.

4.2 Floodways

Encroachment on flood plains, such as artifical fill, reduces the flood-carrying capacity and increases flood heights, thus increasing flood hazards in areas beyond the encroachment itself. One aspect of flood plain management involves balancing the economic gain from flood plain development against the resulting increase in flood hazard. For purposes of the National Flood Insurance Program, the concept of a floodway is used as a tool to assist local communities in this aspect of flood plain management. Under this concept, the area of the 100-year flood is divided into a floodway and a floodway fringe. The floodway is the channel of a stream, plus any adjacent flood plain areas, that must be kept free of encroachment in order that the 100-year flood be carried without substantial increases in flood heights. As minimum standards, the Federal Insurance Administration limits such increases in flood heights to 1.0 foot, provided that hazardous velocities are not produced. The State of Indiana, however, as set down in the Indiana Flood Control Act of 1945 and the Natural Resources Commission Policy Guidelines, Section 6, adopted March 28, 1974 (Reference 7), has designated that encroachment in the flood plain be limited to that which will cause no significant increase in flood height. As a result, no more than

a 0.1-foot surcharge has been delineated for this study.

The floodways for this study were computed on the basis of equal conveyance reduction from each side of the flood plain. That is, each modified cross section retained the same discharge-carrying capacity as the natural cross section elevation, except that the modified cross sections allow the water-surface profiles to rise up 0.1 foot in order to delineate the floodway. The results of these computations are tabulated at selected cross sections for each stream segment for which a floodway is computed (Table 2).

As shown on the Flood Boundary and Floodway Map (Exhibit 2), the floodway boundaries were determined at cross sections; between cross sections, the boundaries were interpolated. In cases where the floodway and 100-year flood boundaries are close together, only the floodway boundary has been shown.

The area between the floodway and the boundary of the 100-year flood is termed the floodway fringe. The floodway fringe thus encompasses the portion of the flood plain that could be completely obstructed without increasing the water-surface elevation of the 100-year flood more than 0.1 foot at any point. The only areas in the floodway fringe under the Indiana guidelines are areas of ponded water (also referred to in some localities as slack water or backwater) or areas with no conveyance. Typical relationships between the floodway and the floodway fringe and their significance to flood plain development are shown in Figure 2.

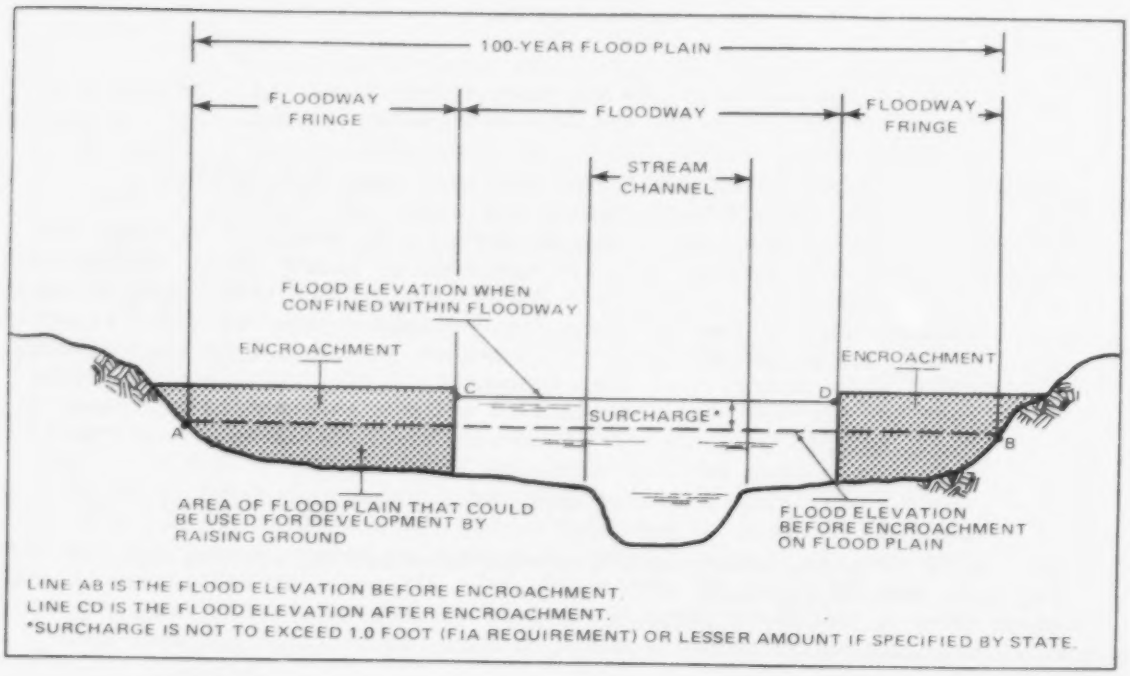

100-YEAR FLOOD PLAIN
FLOODWAY FRINGE
FLOODWAY
FLOODWAY FRINGE
STREAM CHANNEL
FLOOD ELEVATION WHEN CONFINED WITHIN FLOODWAY
ENCROACHMENT
ENCROACHMENT
C
D
SURCHARGE*
A
B
AREA OF FLOOD PLAIN THAT COULD BE USED FOR DEVELOPMENT BY RAISING GROUND
FLOOD ELEVATION BEFORE ENCROACHMENT ON FLOOD PLAIN
LINE AB IS THE FLOOD ELEVATION BEFORE ENCROACHMENT.
LINE CD IS THE FLOOD ELEVATION AFTER ENCROACHMENT.
*SURCHARGE IS NOT TO EXCEED 1.0 FOOT (FIA REQUIREMENT) OR LESSER AMOUNT IF SPECIFIED BY STATE.

Figure 2. Floodway Schematic

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION		
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	WITH FLOODWAY	WITHOUT FLOODWAY (FEET NGVD)	DIFFERENCE
Judy Creek							
A[2]	100	132	443	1.9	723.4	723.1	0.1

[1] Feet Above Upstream Face of Indiana Toll Road
[2] Cross Section Located Outside Corporate Limits

TABLE 2

FEDERAL EMERGENCY MANAGEMENT AGENCY
Federal Insurance Administration

TOWN OF INDIAN VILLAGE, IN
(ST. JOSEPH CO.)

FLOODWAY DATA

JUDY CREEK

5.0 INSURANCE APPLICATION

In order to establish actuarial insurance rates, the Federal Insurance Administration has developed a process to transform the data from the engineering study into flood insurance criteria. This process includes the determination of reaches, Flood Hazard Factors, and flood insurance zone designations for each flooding source studied in detail affecting Indian Village.

5.1 Reach Determinations

Reaches are defined as lengths of watercourses having relatively the same flood hazard, based on the average weighted difference in water-surface elevations between the 10- and 100-year floods. This difference does not have a variation greater than that indicated in the following table for more than 20 percent of the reach:

Average Difference Between 10- and 100-Year Floods	Variation
Less than 2 feet	0.5 foot
2 to 7 feet	1.0 foot
7.1 to 12 feet	2.0 feet
More than 12 feet	3.0 feet

The location of the reach determined for the flooding source of Indian Village is shown on the Flood Profiles (Exhibit 1) and summarized in Table 3.

5.2 Flood Hazard Factors

The Flood Hazard Factor (FHF) is the Federal Insurance Administration device used to correlate flood information with insurance rate tables. Correlations between property damage from floods and their FHF are used to set actuarial insurance premium rate tables based on FHFs from 005 to 200.

The FHF for a reach is the average weighted difference between the 10- and 100-year flood water-surface elevations expressed to the nearest one-half foot, and shown as a three-digit code. For example, if the difference between water-surface elevations of the 10- and 100-year floods is 0.7 foot, the FHF is 005; if the difference is 1.4 feet, the FHF is 015; if the difference is 5.0 feet, the FHF is 050. When the difference between the 10- and 100-year water-surface elevations is greater than 10.0 feet, accuracy for the FHF is to the nearest foot.

FLOODING SOURCE	PANEL[1]	ELEVATION DIFFERENCE[2] BETWEEN 1% (100-YEAR) FLOOD AND			FLOOD HAZARD FACTOR	ZONE	BASE FLOOD ELEVATION (FEET NGVD)[3]
		10% (10-YEAR)	2% (50-YEAR)	0.2% (500-YEAR)			
Judy Creek							
Reach 1	0001	-1.2	-0.4	1.2	010	A2	Varies - See Map

[1]Flood Insurance Rate Map Panel [2]Weighted Average [3]Rounded to Nearest Foot

TABLE 3

FEDERAL EMERGENCY MANAGEMENT AGENCY
Federal Insurance Administration

TOWN OF INDIAN VILLAGE, IN
(ST. JOSEPH CO.)

FLOOD INSURANCE ZONE DATA

JUDY CREEK

5.3 Flood Insurance Zones

After the determination of reaches and their respective Flood Hazard Factors, the entire incorporated area of the Town of Indian Village was divided into zones, each having a specific flood potential or hazard. Each zone was assigned one of the following flood insurance zone designations:

Zone A2:	Special Flood Hazard Areas inundated by the 100-year flood, determined by detailed methods; base flood elevations shown, and zones subdivided according to Flood Hazard Factors.
Zone B:	Areas between the Special Flood Hazard Areas and the limits of the 500-year flood including areas of the 500-year flood plain that are protected from the 100-year flood by dike, levee, or other water control structure; also areas subject to certain types of 100-year shallow flooding where depths are less than 1.0 foot; and areas subject to 100-year flooding from sources with drainage areas less than 1 square mile. Zone B is not subdivided.
Zone C:	Areas of minimal flooding.

The flood elevation differences, Flood Hazard Factors, flood insurance zones, and base flood elevations for each flooding source studied in detail in the community are summarized in Table 3.

5.4 Flood Insurance Rate Map Description

The Flood Insurance Rate Map for Indian Village is, for insurance purposes, the principal result of the Flood Insurance Study. This map (published separately) contains the official delineation of flood insurance zones and base flood elevation lines. Base flood elevation lines show the locations of the expected whole-foot water-surface elevations of the base (100-year) flood. This map is developed in accordance with the latest flood insurance map preparation guidelines published by the Federal Insurance Administration.

6.0 OTHER STUDIES

The Flood Insurance Study for St. Joseph County (including Judy Creek) covers the incorporated areas of Indian Village (Reference 3). The flood profiles for Judy Creek through Indian Village showed a head buildup behind the Indiana Toll Road culvert, which is approximately 120 feet downstream of the Indian Village corporate limits. The HEC-2 computer model showed that the coded opening of the Indiana Toll Road culvert is 16 feet by 4.8 feet. An inspection of the culvert showed that the actual opening of the culvert is 16 feet by 7.5 feet, although the design plans from the Indiana Toll Road Commission indicated the opening to be 16 feet by 9 feet. The bottom of the culvert, however, has become silted in with sand and gravel.

By recoding the HEC-2 model to allow for the actual opening, the 100-year water-surface elevation was lowered approximately 2.3 feet upstream of the Indiana Toll Road. The lowering of the water-surface elevation within Indian Village also affects the water-surface elevations of the St. Joseph County study between the eastern corporate limits of Indian Village and Ironwood Road.

As a result of the use of more recent data, this Flood Insurance Study supersedes the previously published Flood Insurance Study for St. Joseph County (Reference 3).

This study is in general agreement with the previously published Flood Hazard Boundary Map for the Town of Indian Village (Reference 8).

This study is authoritative for the purposes of the National Flood Insurance Program; data presented herein either supersede or are compatible with all previous determinations.

7.0 LOCATION OF DATA

Survey, hydrologic, hydraulic, and other pertinent data used in this study can be obtained by contacting the Insurance and Mitigation Division, Federal Emergency Management Agency, 1 North Dearborn Street, Chicago, Illinois 60602.

8.0 BIBLIOGRAPHY AND REFERENCES

1. U.S. Department of Commerce, Bureau of the Census, 1970 Census of Population, Number of Inhabitants, Indiana, 1971

2. U.S. Department of Agriculture, Soil Conservation Service and Purdue University, Cooperative Extension Service, Purdue Extension Publication AY-50, General Soils Maps and Interpretation Tables for the Counties of Indiana, November 1971

3. U.S. Department of Housing and Urban Development, Federal Insurance Administration, Flood Insurance Study, St. Joseph County, Indiana, (Unincorporated Areas), August 1978

4. U.S. Department of the Army, Corps of Engineers, Hydrologic Engineering Center, HEC-2 Water-Surface Profiles, Computer Program 723-X6-L202A, Davis, California, October 1973

5. U.S. Department of the Interior, Geological Survey, 7.5-Minute Series Topographic Maps, Scale 1:24,000, Contour Interval 5 feet: South Bend East, Indiana (1969)

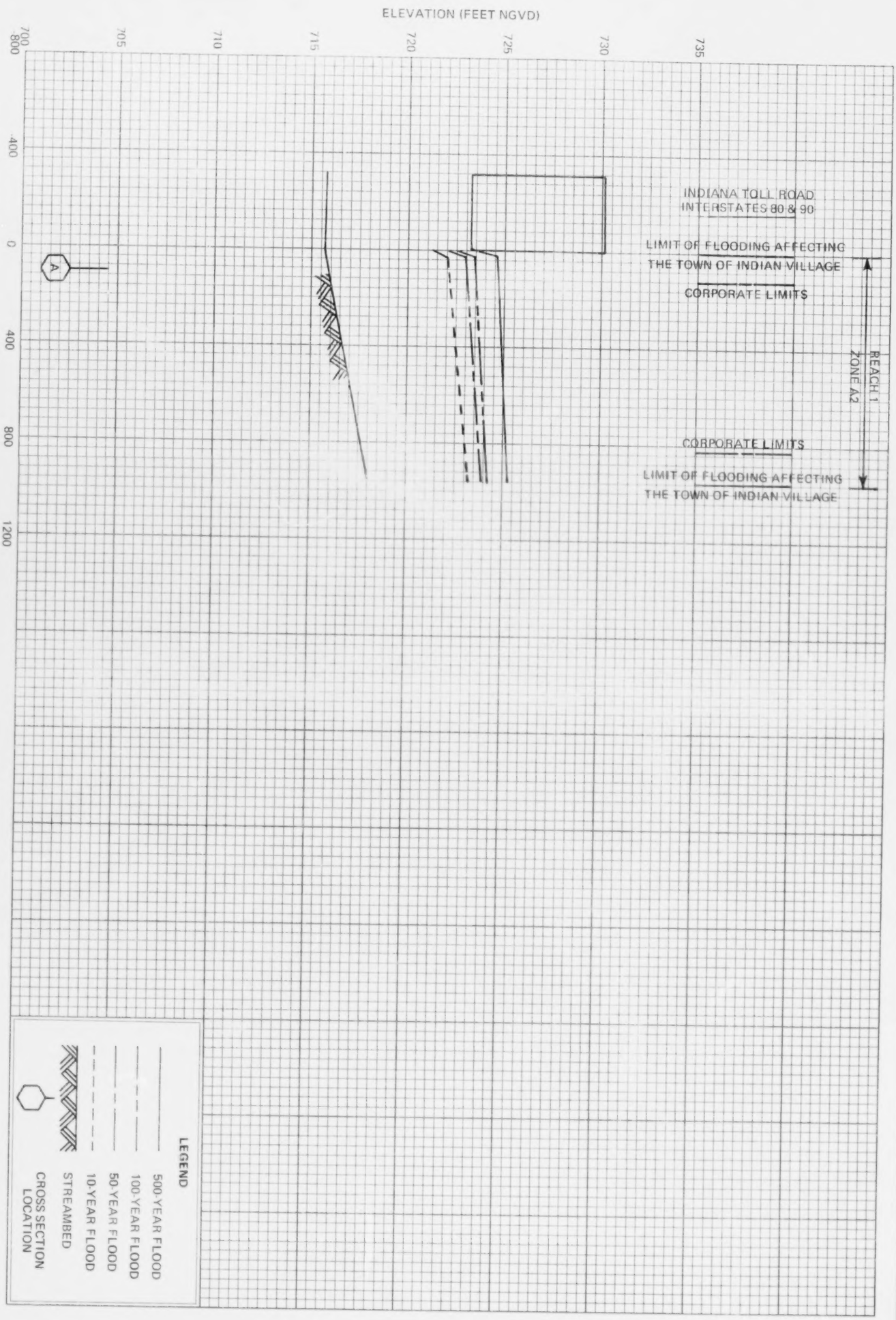
6. U.S. Department of Housing and Urban Development, Federal Insurance Administration, Flood Insurance Study, Roseland, Indiana, August 1975

7. Indiana Department of Natural Resources, Guidelines for Delineation of Floodways and Flood Hazard Areas, March 28, 1974

8. U.S. Department of Housing and Urban Development, Federal Insurance Administration, Flood Hazard Boundary Map, Indian Village, St. Joseph County, Indiana, Scale 1:4800, 1976

U.S. Department of the Interior, Geological Survey, Water-Resource Data For Indiana - 1966 Through 1971

U.S. Water Resources Council, "A Uniform Technique for Determining Flood Flow Frequencies," Bulletin 15, December 1967



01P	FEDERAL EMERGENCY MANAGEMENT AGENCY Federal Insurance Administration **TOWN OF INDIAN VILLAGE, IN** (ST. JOSEPH CO.)	**FLOOD PROFILES** **JUDY CREEK**